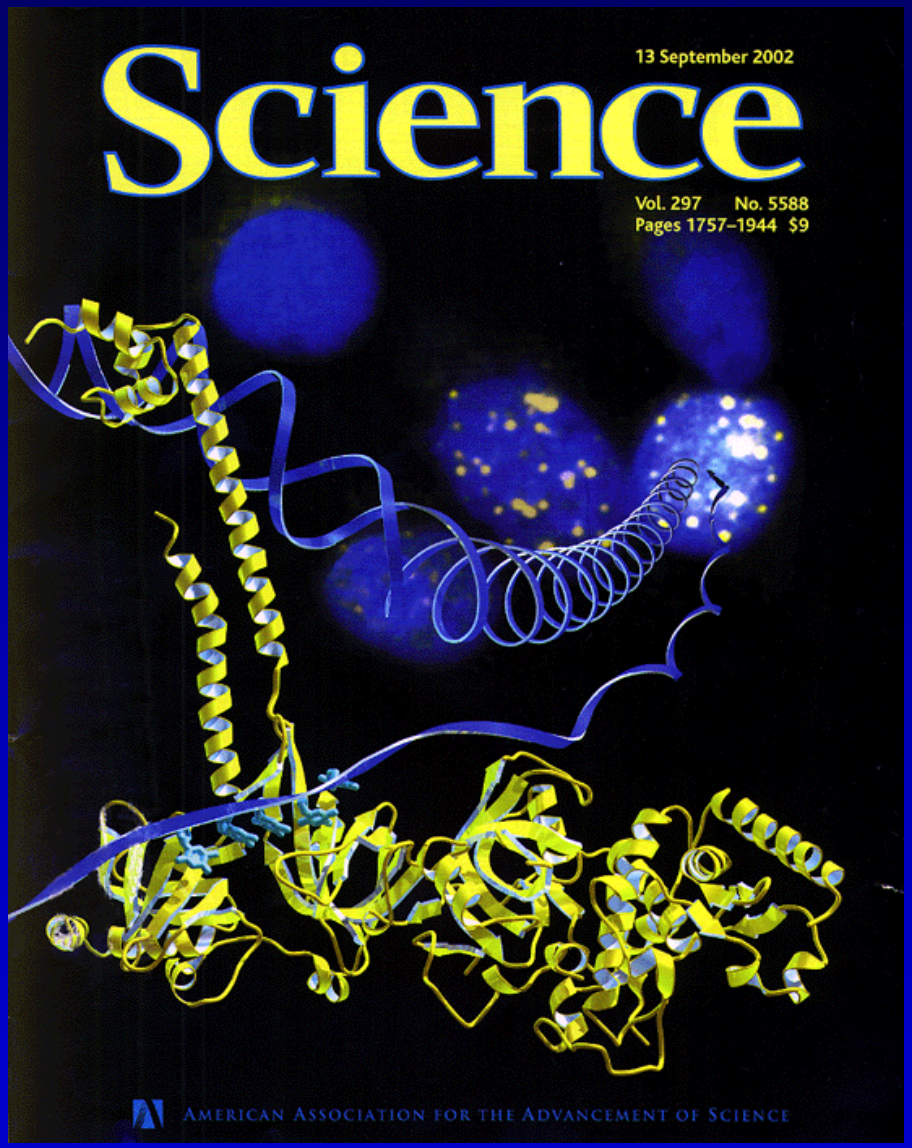
Advanced Photon Source

State of the APS

January 15, 2003

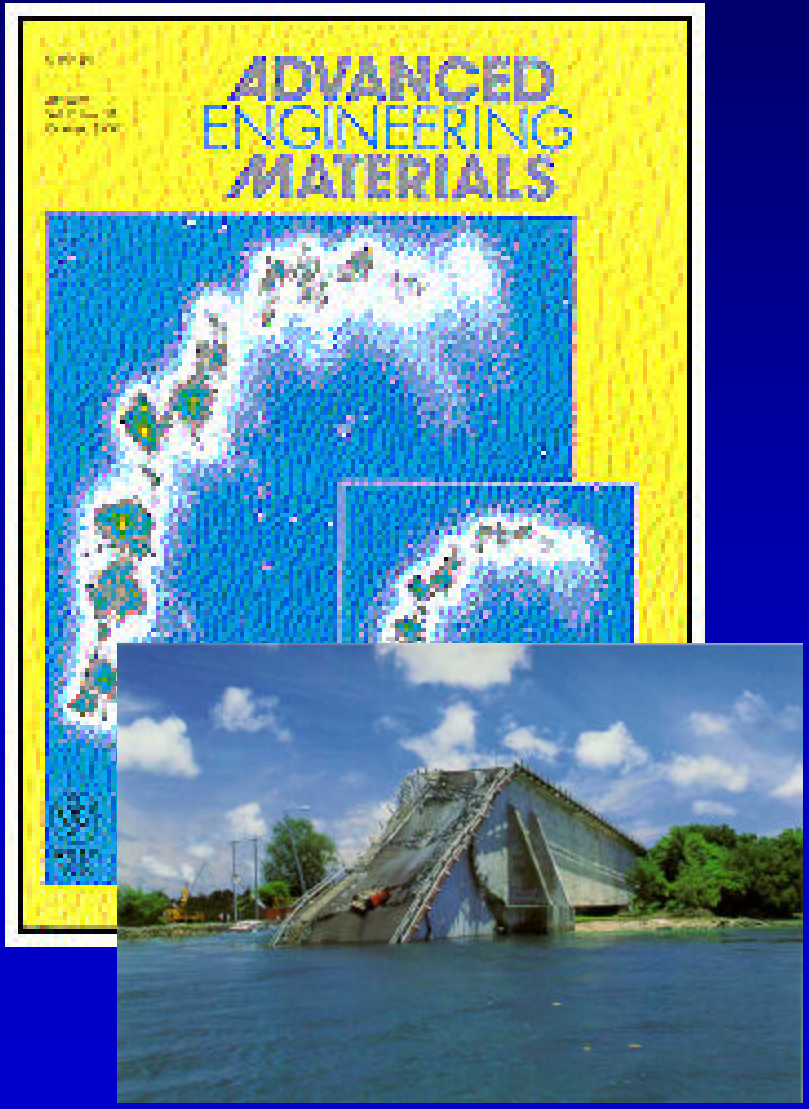
J. Murray Gibson
Associate Laboratory Director

Fighting breast cancer…..



Scientists from Sloan Kettering used SBC and COM-CAT at APS to understand how mutations in the BRCA2 (breast cancer susceptibility gene 2) tumor suppressor can inhibit its ability to repair DNA.

Preventing disaster….



Real materials are “polycrystalline” and their synthesis and behavior can be explained only if individual grains can be examined. APS allows penetrating x-ray beams to be focused onto individual grains within thick pieces of metal (complementary to neutron scattering).

Pacesetter goes to C. Liu and L. Assoufid in recognition of improved mirror fabrication by differential deposition

Keeping the backyard safe for our children…

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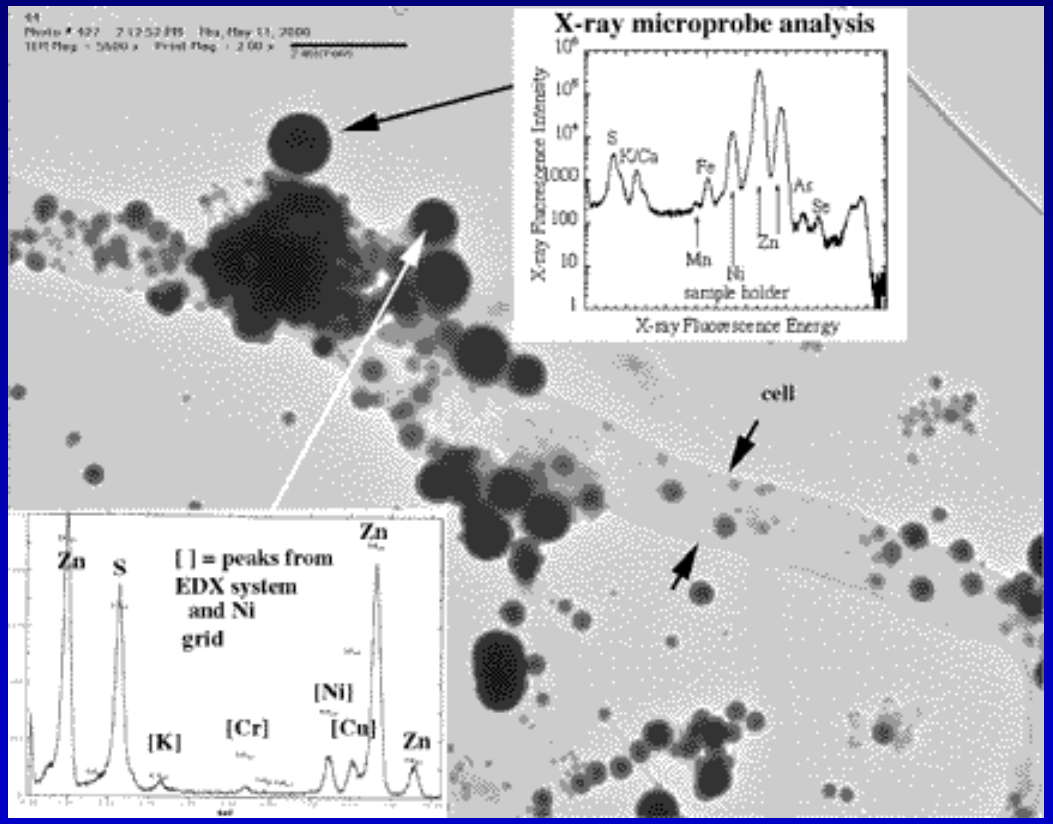
APS beams can detect extremely small concentrations of impurities and their chemical bonding



Zinc and other metals can be remediated by bacteria in deep wells

Questions about uranium fixation of uranium in a Washington mine…

Ken Kemner – MR CAT

Helping to light the world…

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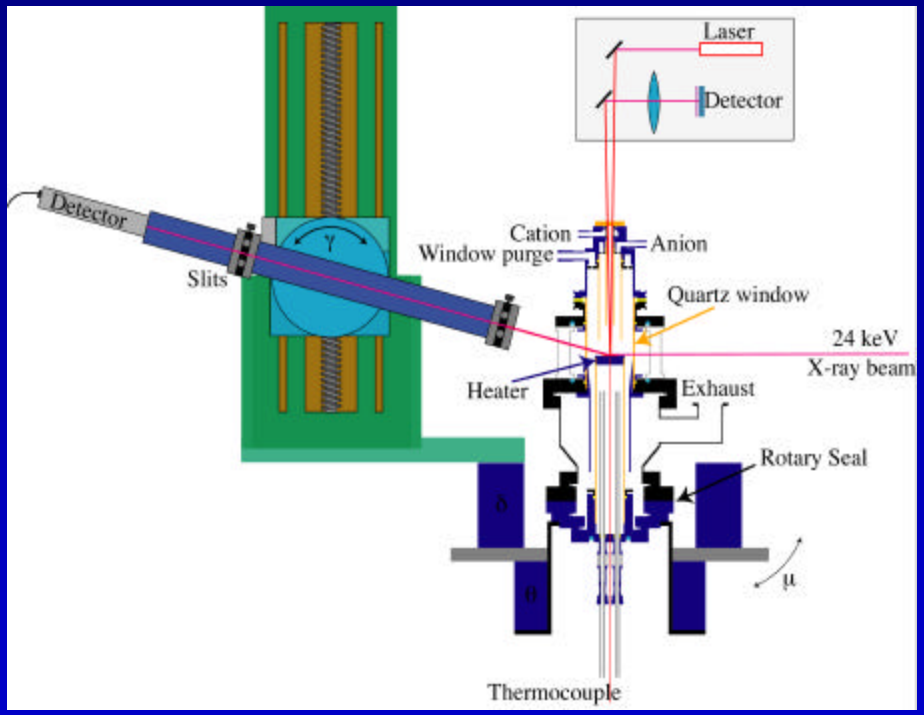
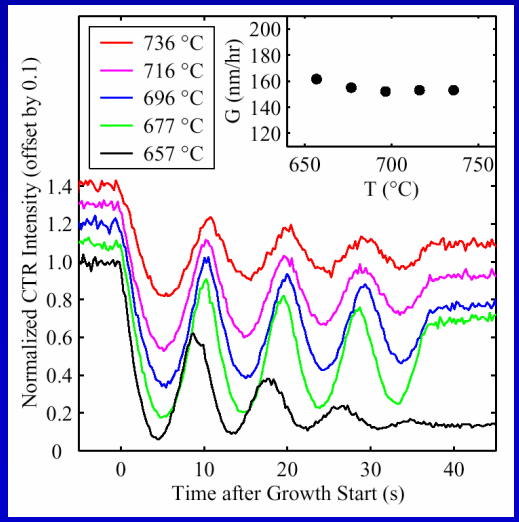
New GaN semiconductors at 10x efficiency could replace incandescent bulbs

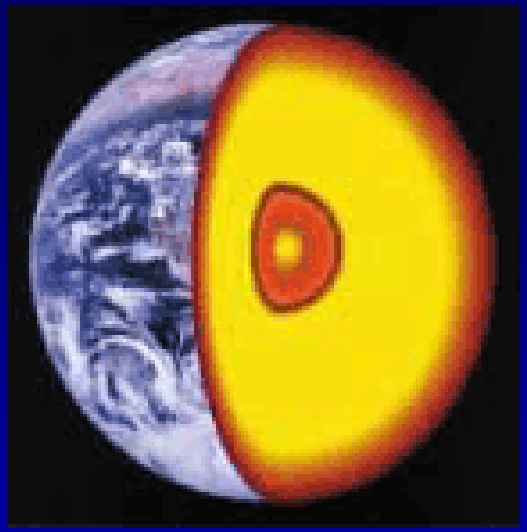


Fabrication by Chemical Vapor Deposition – APS x-rays can penetrate vapor and optimize growth *in situ*



BESSRC CAT – Brian Stephenson..

Materials under pressure..



Extreme environments are important in understanding planetary science, explosives and predicting new materials behavior

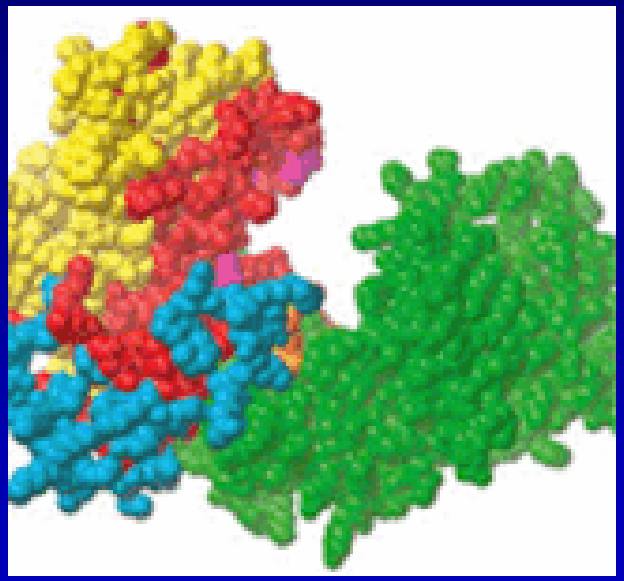
e.g. APS Users predict unexpected forms of iron in the earth's core

Science **295**, 313-315 [2002]

Recent high-pressure CAT is a collaborative venture between Carnegie Institute of Washington, Universities and the DOE's NNSA

APS brilliant x-ray beams can examine the tiny quantities of material at extreme pressures and temperatures in a diamond anvil cell

Helping to combat terrorism…

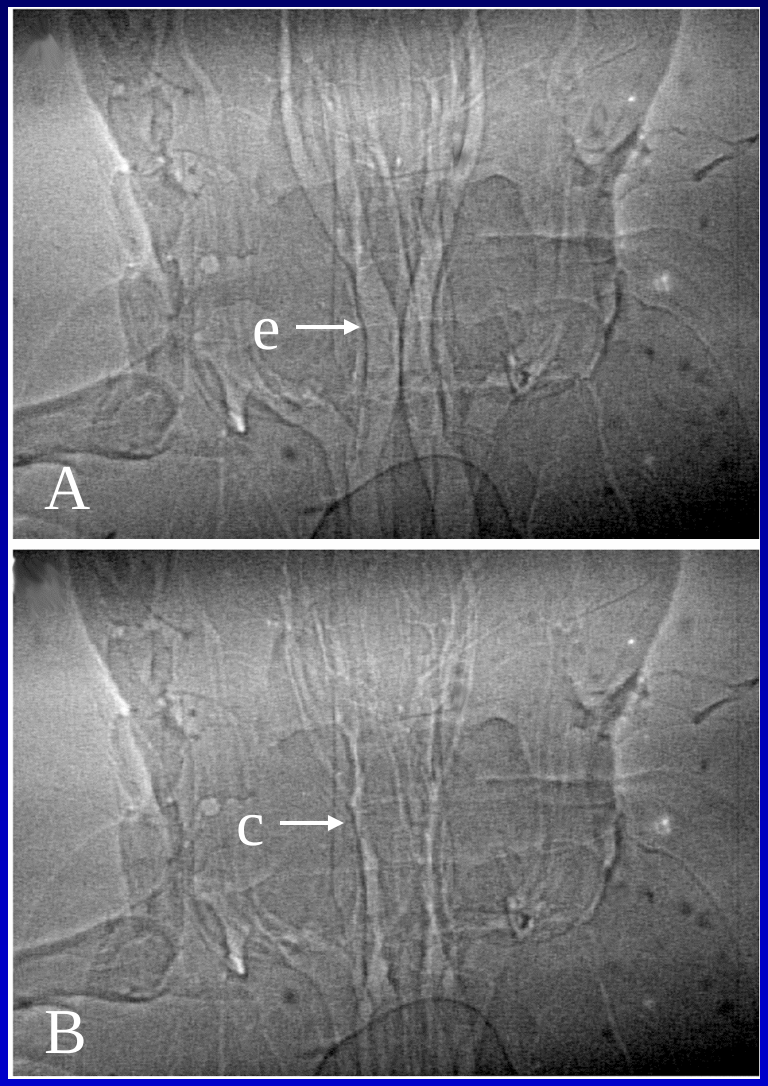


Anthrax Edema Factor in action (U. Chicago)

Hold your breath….

Insects breathe in and out (respiration by tracheal compression) to scientist's surprise…

Pictures of the head and thorax of the beetle *Platynus decentis* Dorsoventral view, head up, sides left and right:



M. W. Westneat, O. Betz, R. W. Blob, K. Fezzaa, W. J. Cooper, and W.-K. Lee, "Tracheal respiration in insects visualized with synchrotron x-ray imaging," Science, in press (anticipated cover story, Jan. 24, '03).

What made it all possible?

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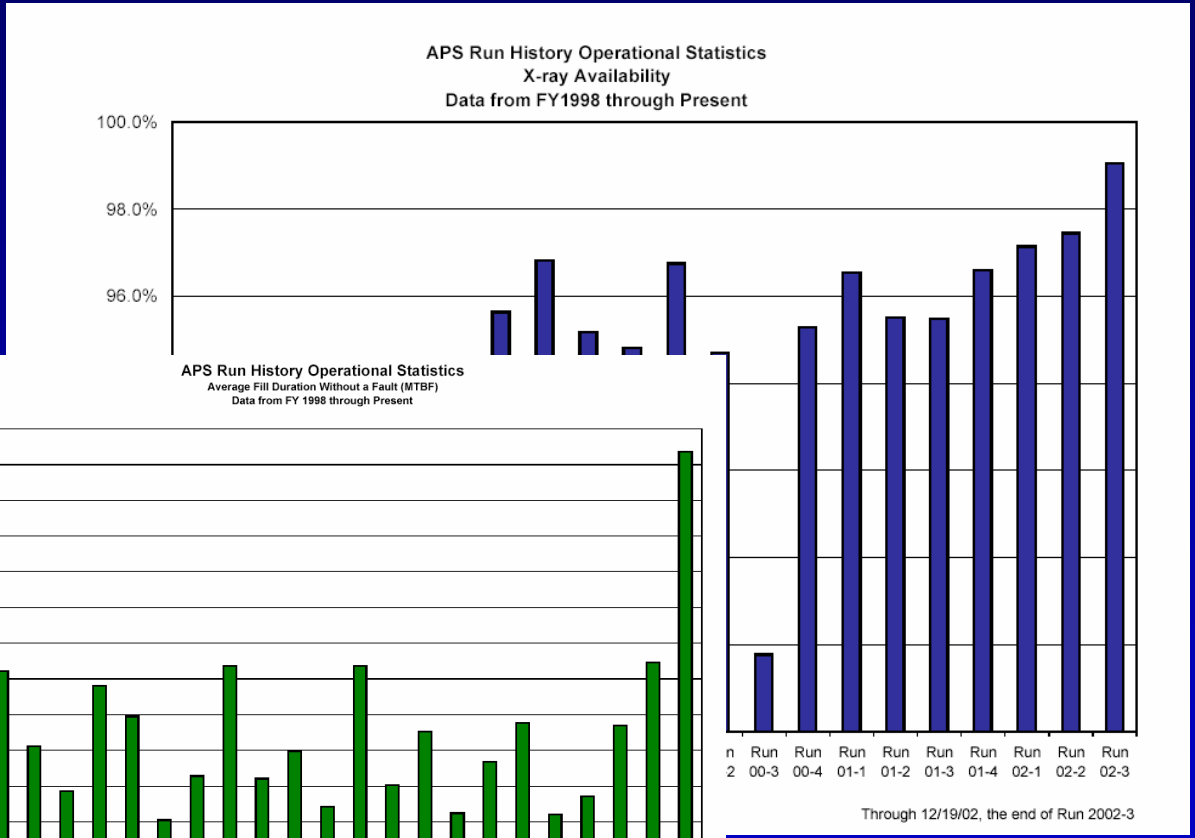
- Reliability
- Performance
- Dedication
  to support users
- Innovation



APS Employees

THANKS AND CONGRATULATIONS!

APS grows every year….

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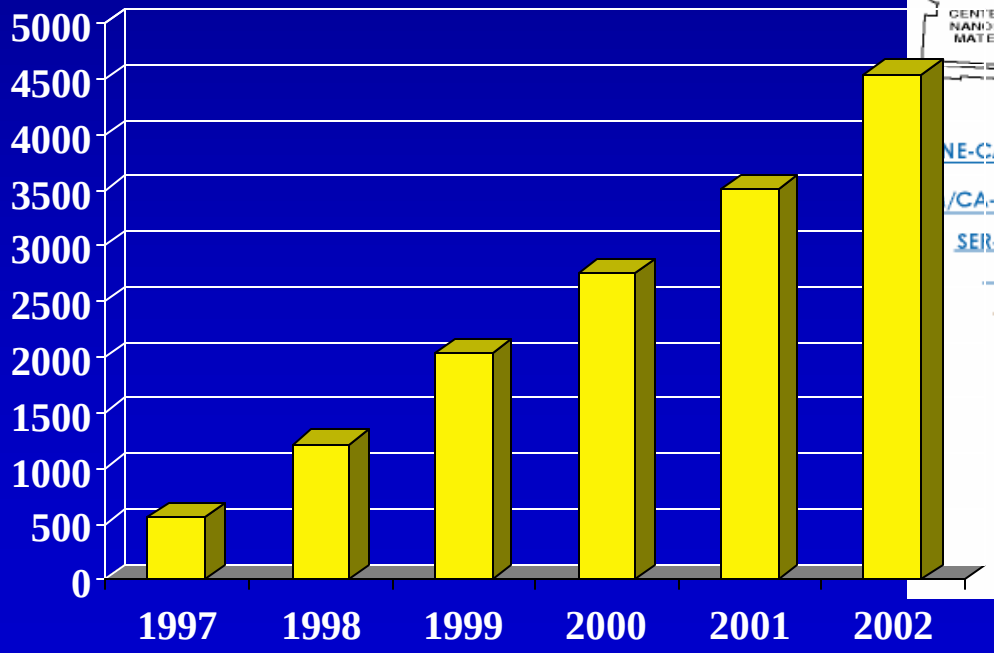
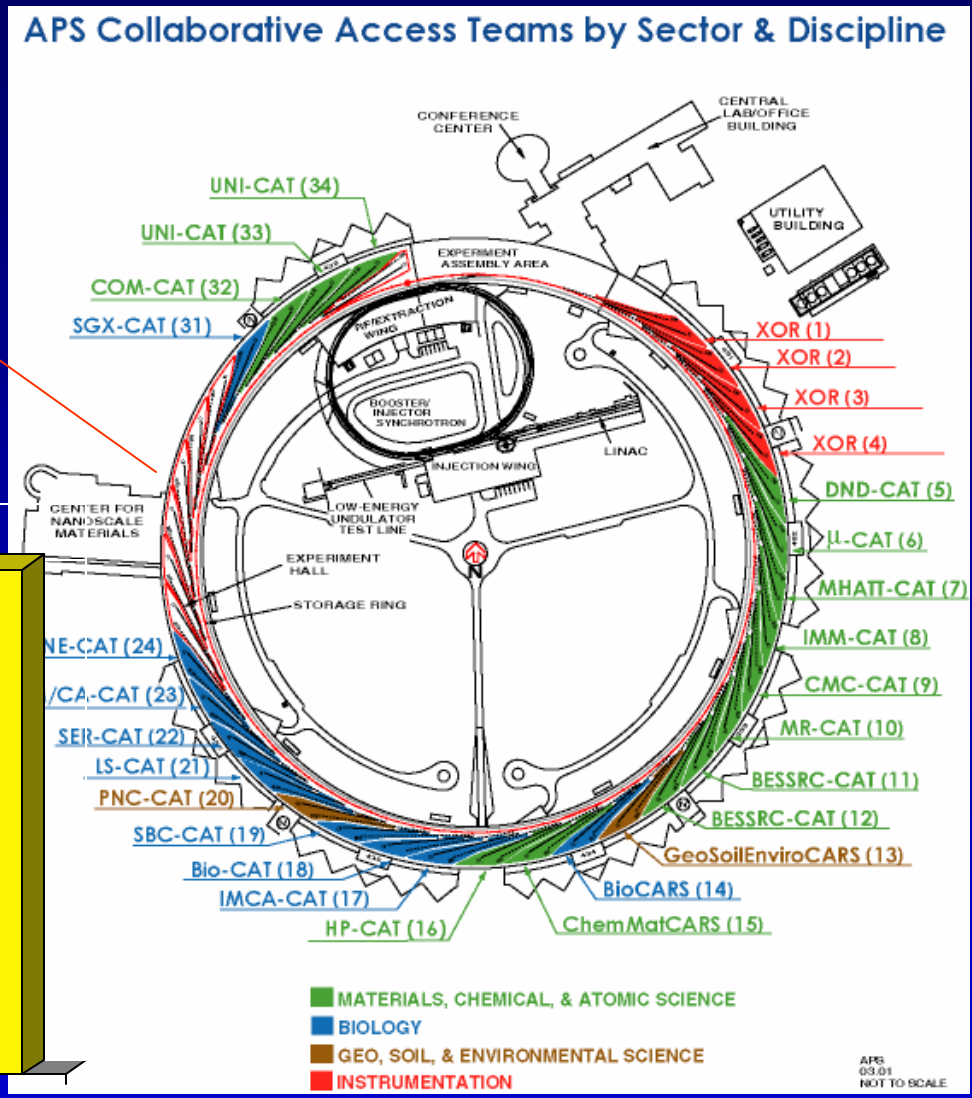
IXS CAT
NANO CAT

Badged Users





Construction activities continue

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- Building 436
- Building 450

Not one contractor injury in five years…

Center for Nanoscale Materials

State Contribution FY'02 = $2M, FY'03 = $17M
Building construction begins Summer '03
DOE approves CD-0, anticipated funding $30-40M

Free-Electron Lasers – *the excitement of fs science*

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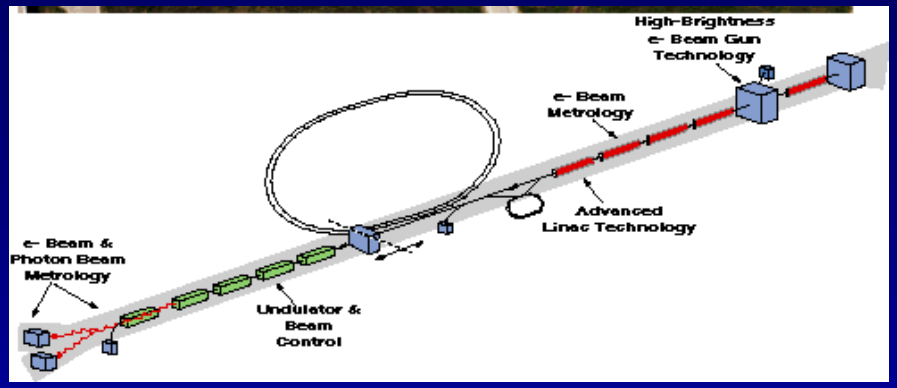
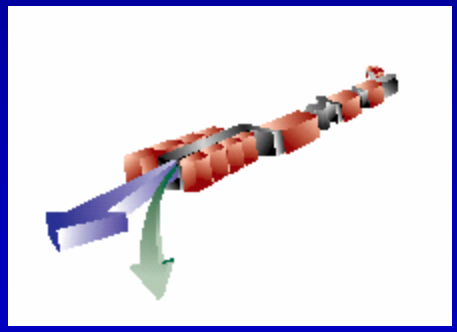
- LEUTL has SPIRIT
  - Experiments ongoing to use single photon ionization from LEUTL source for materials science
  - Proposal submission to BES for upgraded, independent facility (decision point FY ’04)



- LCLS

15 GeV Electrons — LCLS — 1.5 Å X-Ray

Linac Coherent Light Source



APS to provide undulators at ~$50M responsibility
Steve Milton to be ANL LCLS Project Director
Kathy Harkay to lead Accelerator Physics Group

The first centralized general-user program

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Imaging/ Microbeam	Scattering Applied Materials	Scattering Condensed Matter	Scattering Chem/Biol/Environ	Small Angle Scattering (SAXS)	Spectroscopy (EXAFS)
Chris Jacobsen, Chair	Paul Fuoss, Chair	Joel Brock, Chair	Neil Sturchio, Chair	Larry Lurio, Chair	Joe Woicik, Chair
Barry Lai John Miao Mark Rivers	I. Cev Noyan Carol Thompson Robert A.Winholtz	Jay Bass John Hill Ben Larson Young S. Lee Guoyin Shen	David Tiede Angus Wilkinson	Andrew Allen Jyotsana Lal David Londono Pappannan Thiyagarajan	Lisa M. Miller Sue Mini Matt Newville

Proposal Review Panels

except macromolecular crystallography (MC)

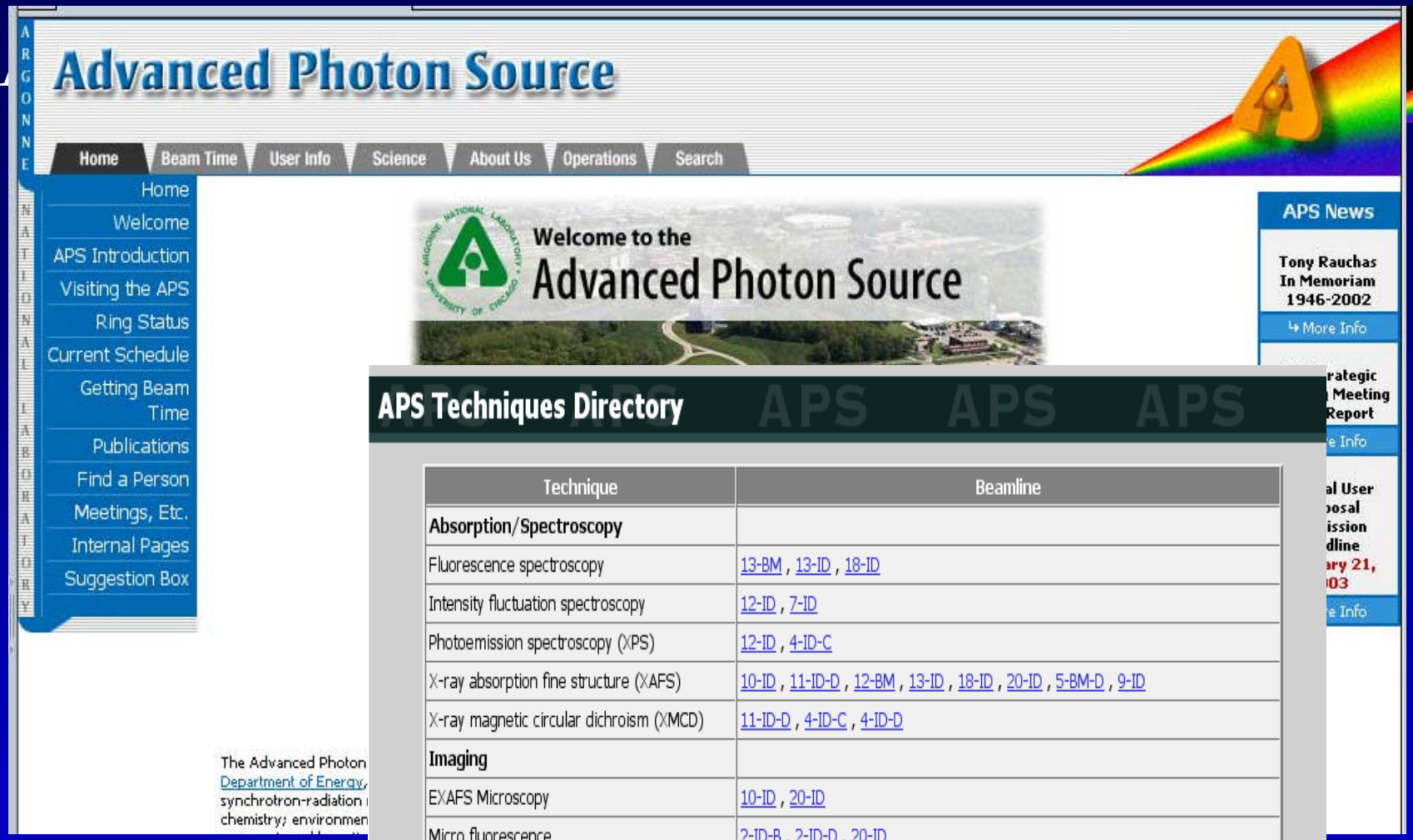
Beamtime Allocation Committees

Macromolecular Crystallography	All Other Science
Keith Brister Robert Fischetti Stephan Ginell Andy Howard Zdzislaw Wawrzak	Jon Tischler Steve Heald Brian Stephenson Denis Keane

Type	Number	Successful
All	322	58%
All but MC	272	54%
MC	50	80%

Statistics

About 3000 shifts were requested, and 2000 shifts were available for general users



Technique	Beamline
Absorption/Spectroscopy	
Fluorescence spectroscopy	13-BM , 13-ID , 18-ID
Intensity fluctuation spectroscopy	12-ID , 7-ID
Photoemission spectroscopy (XPS)	12-ID , 4-ID-C
X-ray absorption fine structure (XAFS)	10-ID , 11-ID-D , 12-BM , 13-ID , 18-ID , 20-ID , 5-BM-D , 9-ID
X-ray magnetic circular dichroism (XMCD)	11-ID-D , 4-ID-C , 4-ID-D
Imaging	
EXAFS Microscopy	10-ID , 20-ID
Micro fluorescence	2-ID-B , 2-ID-D , 20-ID
Microprobe	13-BM , 13-ID , 2-ID-D , 20-ID , 7-ID
Phase contrast imaging	1-ID
Photoemission electron microscopy (PEEM)	4-ID-C
Radiography	1-BM
Tomography	13-BM , 2-BM , 5-BM-C
PROTEIN CRYSTALLOGRAPHY	
Macromolecular crystallography	14-BM-C , 14-BM-D , 14-ID , 17-ID , 19-BM , 19-ID , 5-ID
Multi wavelength anomalous dispersion (MAD)	14-BM-C , 14-BM-D , 14-ID , 17-ID , 19-BM , 19-ID

XOR will do it all

- X-Ray Operations and Research (XOR) in XFD
- Former SRI CAT embraces need
  - To continue innovation in instrumentation
  - To build new user communities
  - And to take more responsibility for operating BES beamlines
    - To be a model of BES sector operation, with >50% general user time
  - Thanks for continuing to provide dedicated user support (largest number of general users accommodated through XOR), and maintaining innovation

Welcome BES Sectors

- BESSRC (11 and 12)

Staff joining APS under group leader Mark Beno as a new group in XOR

- Partners (some APS staff, other external support)
  - IMM (8)
  - MHATT (7)
  - PNC (20)

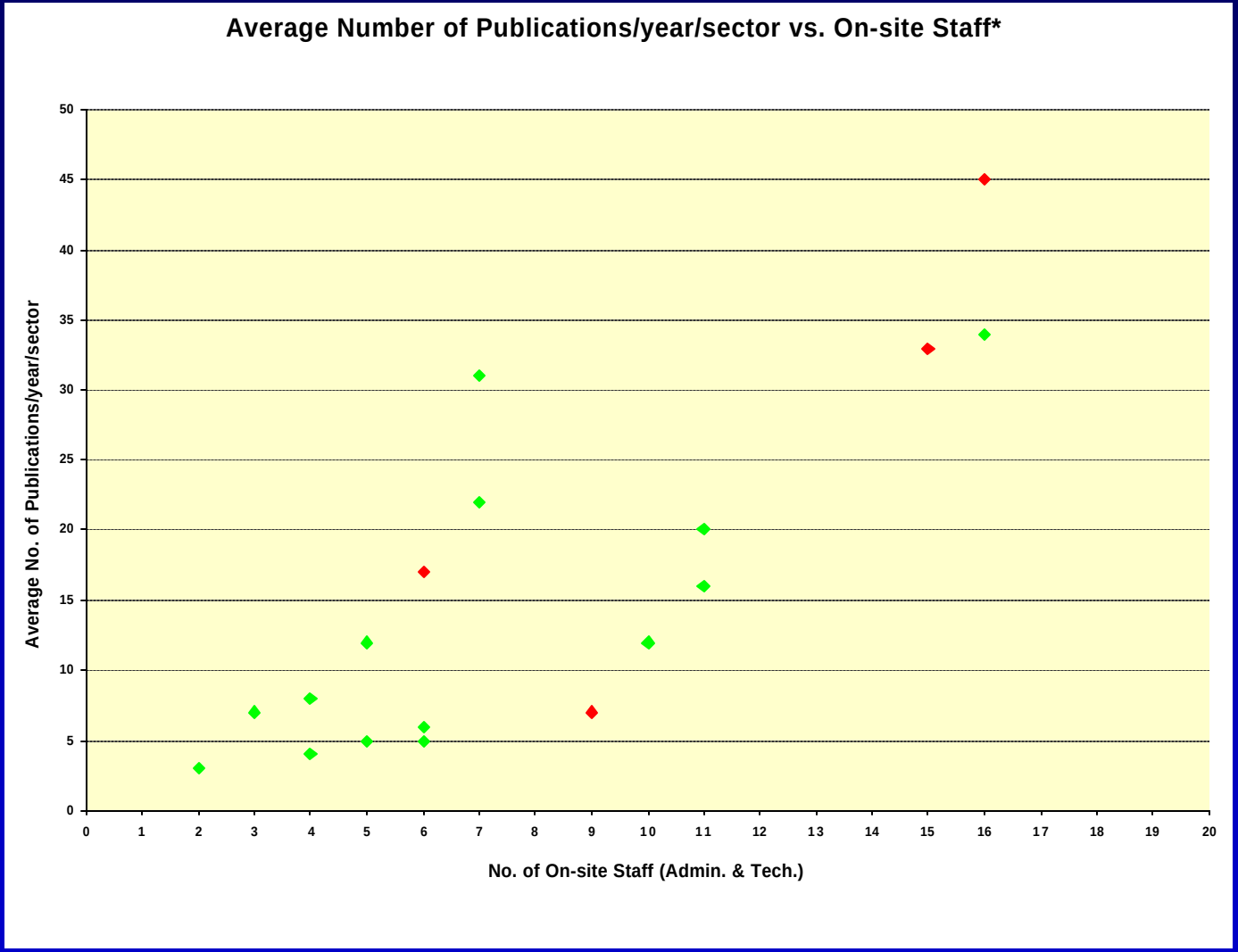
Sector	Existing APS Staff	Jobs postings
8 (IMM)	1 donated	1
7 (MHATT)	2 term	1
20 (PNC)	1 term	2
Total	4	4

Support for 8 staff members, M&S, capital = $1770K in FY ’03
Indirect support of $1M promised by ANL.

These three sectors offer 50% GU time and specialize activities

Future transitions slowed

Issues with operational support for CATs



clear relationship between support level and productivity

The evolution of the CAT system

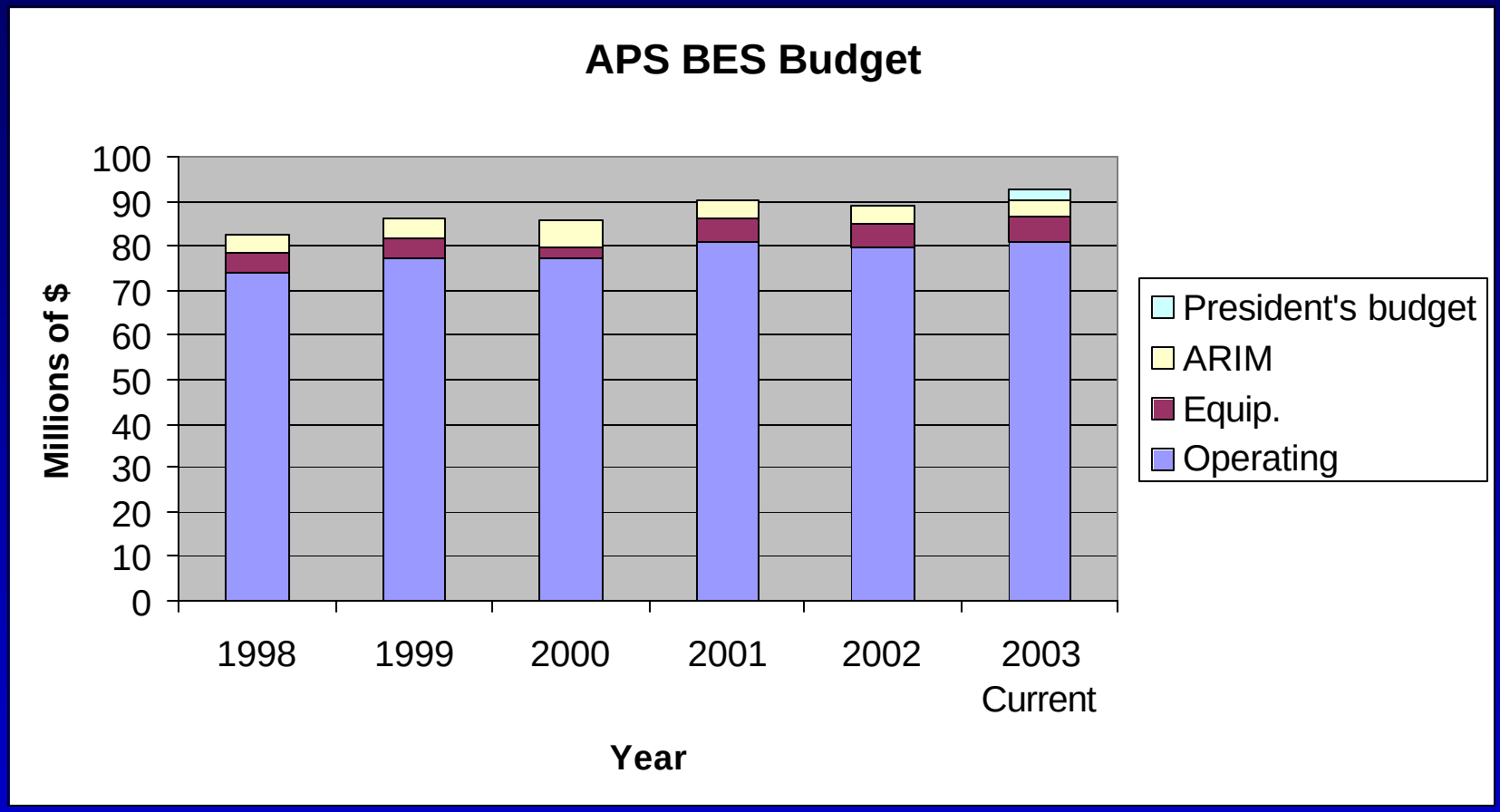
- CAT model has advantages and disadvantages
- Advantages
  - Leveraging of funds
  - Outside drivers and partners for facility
  - Strong connection with universities
  - Creative diversity
- Disadvantages
  - Tendency to avoid specialization and ignore duplication
    - Increased operational burden
  - Challenge to sustain stable operational support
- APS/DOE is working on introducing more flexible partnerships, retaining strong autonomous CATs

Science Advisory Committee (SAC)

- Fourteen members plus APSUO Chair
- Inherits and expands responsibilities of Program Evaluation Board
- First meeting Jan. 21-23, 2003
- Sector reviews (3-year period) held by one-day stand-alone panels
  - First SRP panel meetings Nov. 19, 20, and 21
  - CMC, MU, and DND
- SAC acts on SRP recommendations at annual meeting
    - more details on web pages

The group has made an outstanding contribution to the radiation safety program at the APS, by creating a complete shielding configuration database for all of the APS accelerators. This activity demonstrates their commitment to the radiation safety program at the APS and shows excellence in performance beyond normal job expectations.

Budget



Current budget $90.1M = last year + $1.3M for BESSRC

Anticipated President's budget increment = $2.1M

Staffing levels

- January 2002, 443.15 FTEs
- Today 420 FTEs (including 8 from BESSRC who came with extra funding)
- Staff level consistent with President's budget level for FY'03
- Expect future growth in staff and budget for user support
  - other activities should remain stable

Budget Planning/Strategic Planning

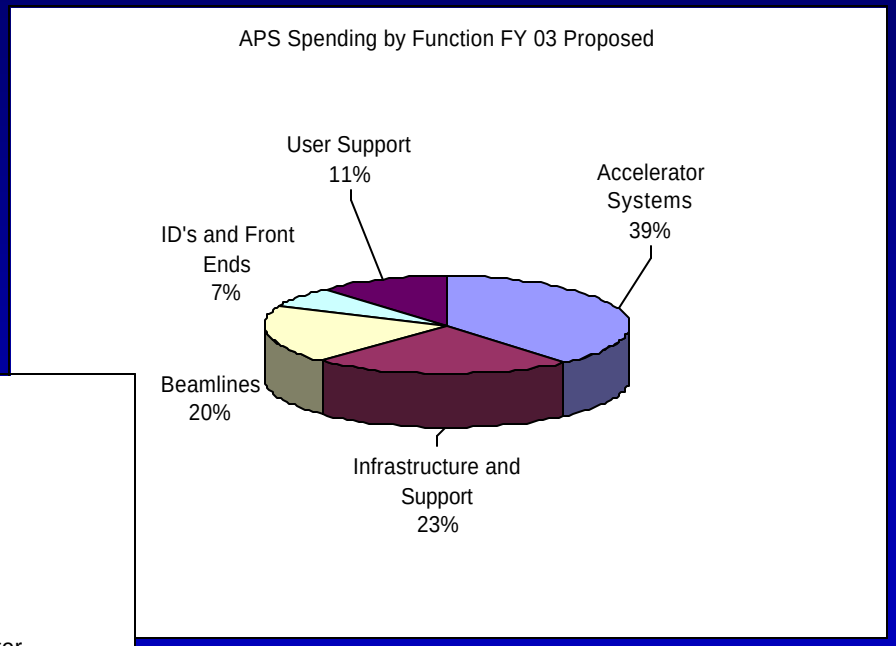
- Initial assignments of operating budget made:
  - Core program levels trimmed ~4.4% from requests
- New activities started

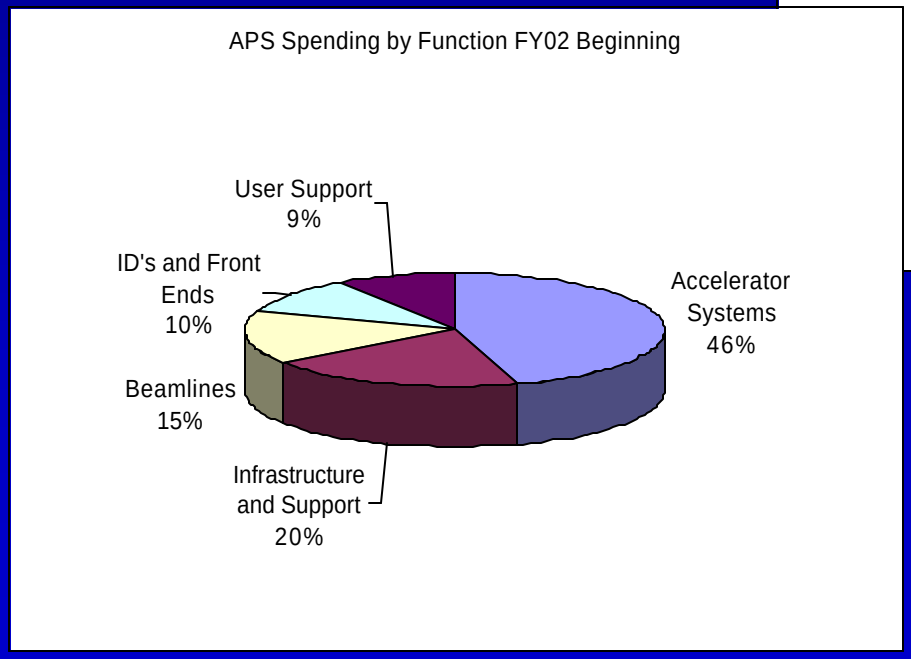
Item	*K$*
MCR Cooling and Conventional Facilities	596
Enhanced User Administration	124
Central scheduling/utilization system	227
Webmaster	180
BES-CAT Operation	700
Novel ID Development	291
Publicity	800

- New activities planned with President's budget

Increased beamline controls and data acquisition to users	124
Local network and computing infrastructure at user beamlines	250
BES CAT Operation	1070
Grad Stud Support	130
Detector Pool	310
IXS CAT	316
Nano CAT	284
Document control	200
Additional Publicity	200

Increased emphasis on user support





Other areas are stable

We will foster major enhancements

- Accelerator side
  - ASD preparing roadmap of options by end of year
  - Will share with users and make decisions on where to move forward
- Insertion devices
  - Activities in progress – short period, variable period, superconducting
  - Workshop was held in December
- Beamlines – partnering encouraged
- User dialog important for all these
- Additional resources will be set aside to fund major innovations in all three areas

Capital equipment and ARIM assigned

ARIM	K$
Top-Up Diagnostics (WP01563)	286
Beam Stability (WP01472)	644
UVC Power Systems Upgrade (WP01561)	89
FEEPS/PSS upgrades (WP01589)	36
SR Power Supply Upgrade (WP01576)	118
Real time video distribution	244
VME chassis upgrade	113
Centralized UPS system	32
Front end upgrades	665
Televac gauges, cables, cont.	68
Superconducting UL	275
Ion pumps (WP01593) - reliability	*556*
Spectra RGA vacscan plus - ring vacuum	*340*
RF Test Stand	*568*
Sector 35 Ugrades	*292*

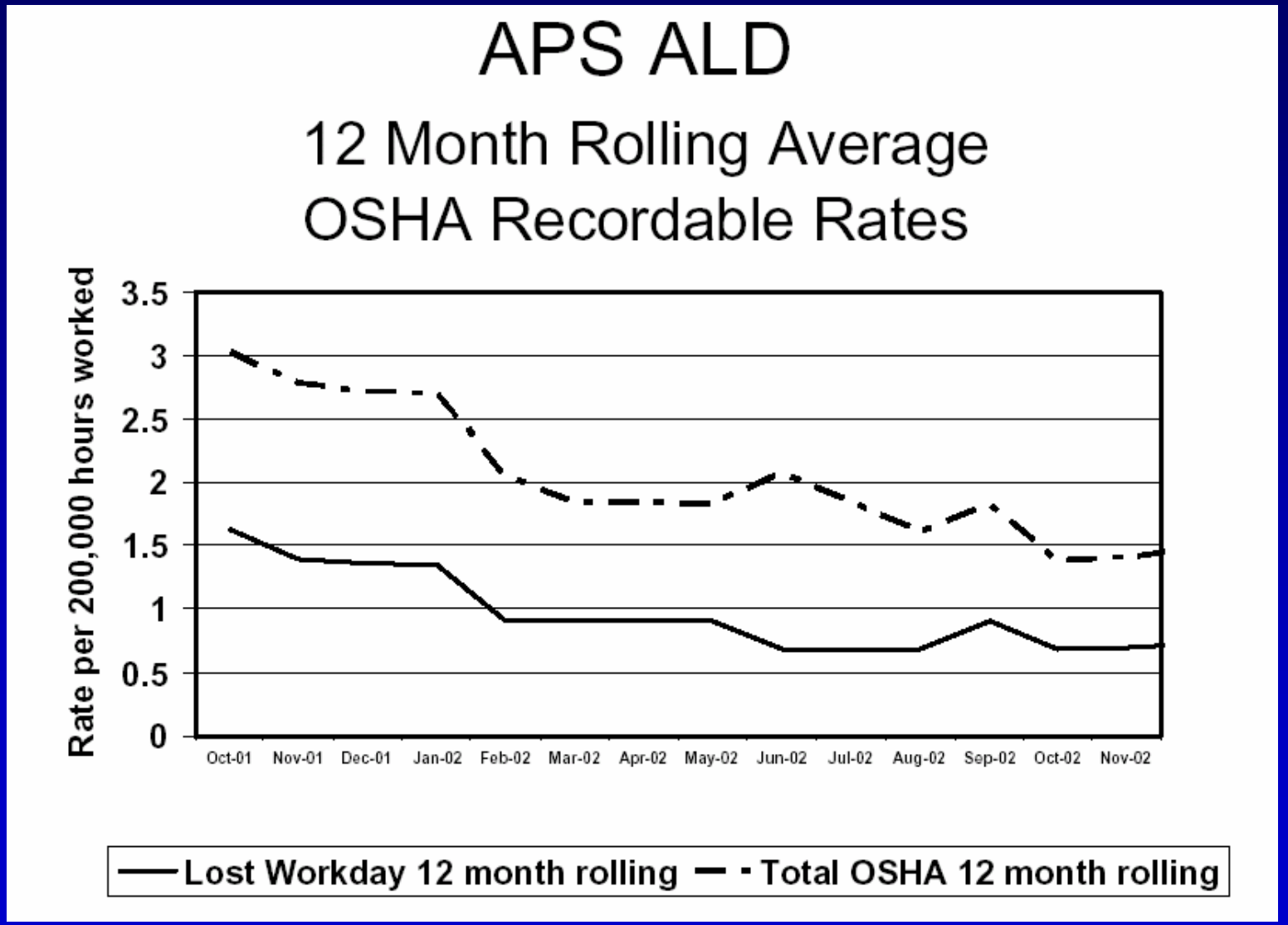
President's budget needed to fund additional items

Capital	$K
Upgrades to CAT LOM Network & Computer Gateways	714
Upgrades to Central Computing (see attached for details)	685
Tune Measurement	61
Application Server Partitioning	114
High Speed Scope	38
Hardware upgrade (D/D workstation)	44
Laser interferometer for disp/vibration	66
ID support structures –	110
Variable period ID -	165
2.7 cm ID -	220
Cryogenics systems for SC ID	165
1Mpixel Hi-res. Cameras (2)&FO syst.-	182
4Mpixel Hi-res Camera&FO system-	204
Work project for small detectors	350
Components for Sectors 7,8,20	165
Vertical 4T Field magnet-	220
Zone-plates for Sectors 2&4-	220
Two mirrors for Sectors 2&4-	440
Stages for Nanoscope-	88
Nano-CAT FE - short leadtime	*770*
PEEM	*39*
Cryospecimen stage-	*110*
Upgrades to Central Computing (see atta	*100*
Accelerator Computing & Networks (see a	*422*
Reports Server	*29*
Cluster Testbed	*57*
High Speed Scope	*38*
Optical pyrometer	*55*

Competition for innovation

- I have set aside ~$2M ARIM and Capital Equipment (a cushion with current budget uncertainty for FY ‘03)
- I will make resources available to a competitively selected project in each of Accelerator, Insertion Device and Beamline development based on competitive analysis
  - Leveraged funding encouraged with beamline proposals (BES has separate source)
  - Scope over 3-5 years for each project could be $3-5M
- Competition with white papers due by May 1, 2003 – details will follow

A safer workplace…



ANL averages – Workdays 1.47; OSHA 2.61

Through better work planning…

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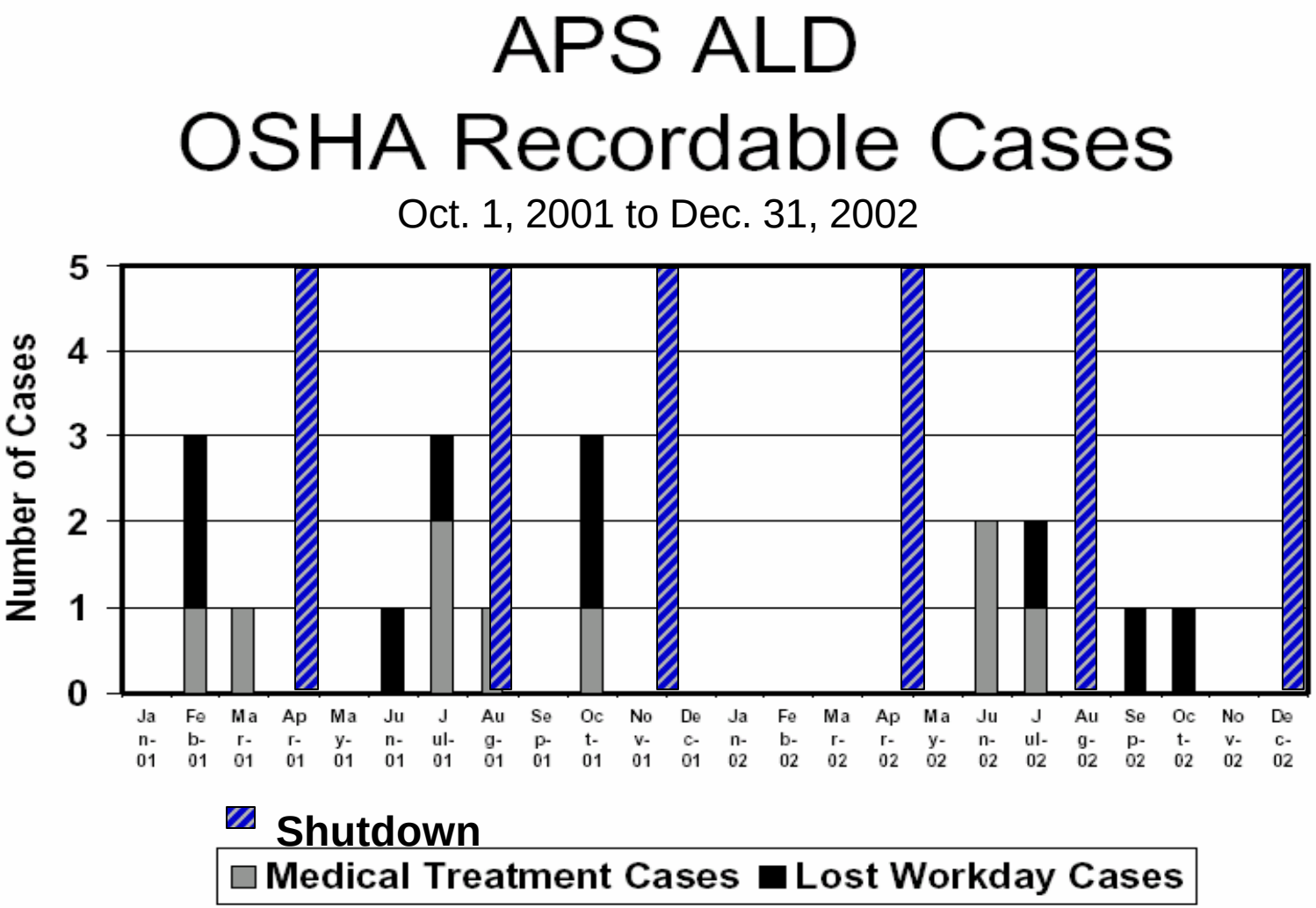


Safety

- Good work planning and a quality approach leads to a safer organization
  - Quality approach to all work practices important
    - e.g. project management, document control
      - Graded approach
- We aim to keeping controls at appropriate level which includes relaxing in some cases– e.g. new dosimetry policy
- Congratulations, but we must continue to strive for improved safety and security
- I appreciate honesty in reporting issues
- No work is so urgent that it cannot be done without due consideration for safety

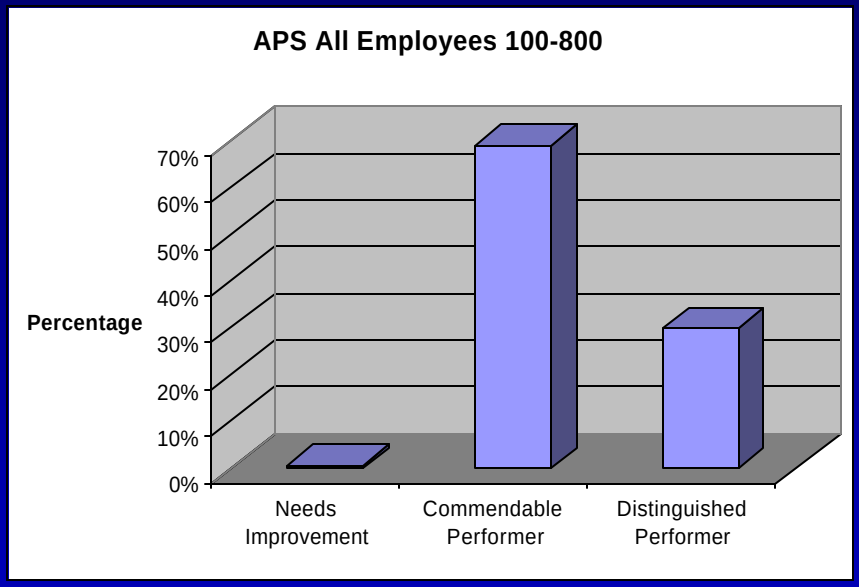
Foster a safe and secure environment

APS Goals for FY '03

- Provide support and oversight for user safety and security issues
- Improve the safety oversight integration across APS divisions and improve the safety and security of APS employees

Performance Appraisal

- New system aims to be more transparent
- Aiming at APS (and lab-wide) standards
  - including each grade, gender, etc.



- Joint goal-setting

- More open discussion of career development, promotion
  - Twice as much money made available for promotions and adjustments this year

Increase the scientific output of users

APS Goals for FY '03

- Implement a centralized general user program
- Provide more support to resident users and CATs
- Operate BES beamlines where required
- Improve Web pages for general user accessibility
- Establish periodic high-quality publications for outreach

Increase the impact of science from APS

APS Goals for FY '03

- Implement a Scientific Advisory Committee and Sector Review Panels
- Optimize beamtime allocation and use
- Encourage and support development of specialized beamlines
- Foster theory activities at APS

Deliver high reliability - *APS Goals for FY '03*

- Ensure availability exceeds 95%
- Increase the MTBF to at least 35 hours
- Improve the reliability of beamlines
- Plan for age and damage-related obsolescence

Innovate instrumentation for improved user science - *APS Goals for FY '03*

- Improve accelerator performance from user perspective
- Develop new insertion devices for innovative science
- Improve and innovate beamline performance

Improve the efficiency and effectiveness of the APS - *APS Goals for FY '03*

- Improve the partnership with CATs and users
- Implement a graded approach to document management
- Facilitate effective and seamless interactions between APS divisions with clearly-defined interfaces and responsibilities
- Improve communication within the APS and user community
- Foster excellent supervision
- Employ a graded approach to project management
- Improve partnerships with Argonne and the University of Chicago
- Improve workplace diversity and working conditions

Improved Communication

- APSEAC
  - APS Employee Advisory Committee
- Suggestion box
- Monthly meetings with resident users

Improving the working climate at APS

- Women in particular but improvements help all
  - Issues raised in study by American Physical Society
  - Task force has suggested improvements
    - Performance appraisal and career development were major issues which we are responding to
    - Communication also was identified
    - Other issues being examined

Support laboratory-wide initiatives – *APS Goals for FY '03*

- Facilitate the Center for Nanoscale Materials and the x-ray nanoprobe
- Support lab-wide coordination of accelerator physics activities

Invest in the future - *APS Goals for FY '03*

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- Support LCLS and associated experimental program
- Recruit outstanding users and staff
- Increase the number of graduate students and foster training in beamline research
- Contribute to the development of future light sources and the broader scientific community

The next 20 years

- BES is roadmapping for major construction projects in next 20 years
- Includes LCLS, SNS upgrades, BNL upgrade and a “green-field” FEL (SLAC, APS, BNL – Kwang-Je Kim)
- “APS Upgrade” presentation on agenda for Feb 22
  - First ten years
    - X-ray source upgrades
    - Beamline construction and operation
  - Second ten years
    - Next generation user facility
    - Accelerator upgrades that retain and exceed existing capabilities?
      - Efim Gluskin to lead one-day discussion group on possibilities

For the future….

- Budget increases and responsibilities for operation of BES sectors (+$10-$15M over 5 years)
- Innovations in accelerator, insertion devices and beamlines
- Seeking proposals for exciting new beamlines (4 remaining uncommitted sectors)
  - Gopal Shenoy and Sunil Sinha to co-chair study on BES mission-related ideas
- Increasing activities in femtosecond science and free-electron lasers
- Exciting times are ahead - it will be a pleasure and privilege to work with you all